Sinewave Generator with AnalogPAK
SLG47003V

Contents

1. References

For related documents and software, please visit:

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Download our free Go Configure Software Hub [1] to open the .gp files [2] and view the proposed circuit design. Use the GreenPAK development tools [3] to freeze the design into your own customized IC in a matter of minutes. Find out more in a complete library of application notes [4] featuring design examples as well as explanations of features and blocks within the GreenPAK IC.

[1] Go Configure Software Hub, Software Download and User Guide, Renesas Electronics
[2] AN-CM-386 Sinewave Generator with AnalogPAK, Design File, Renesas Electronics
[3] GreenPAK Development Tools, GreenPAK Development Tools Webpage, Renesas Electronics
[4] GreenPAK Application Notes, GreenPAK Application Notes, Renesas Electronics
[5] SLG47003V Datasheet

Author: Rostyslav Marushchak

2. Terms and Definitions

EPG	Extended Pattern Generator
MF	Multi-Function Macrocell
OpAmp	Operational Amplifier
Vref	Voltage reference

3. Introduction

This design is developed to be an analog sine wave source that can be used in a variety of devices which might require a sinewave reference, for example a stand-alone, hybrid solar DC/AC converter. Also, because of the availability of the Extended Pattern Generator (EPG) it is possible to specify other waveforms (rectangular, triangular, and trapezoidal). In this Application Note is we will consider the use of a sinusoidal waveform, since this waveform is perhaps the most common.

The generation of a sinusoidal signal occurs by means of a cyclic recording of data from the EPG to the rheostat (RH0), which is included on the low side of the voltage divider R3-RH0 (see Figure 1 and Figure 2).

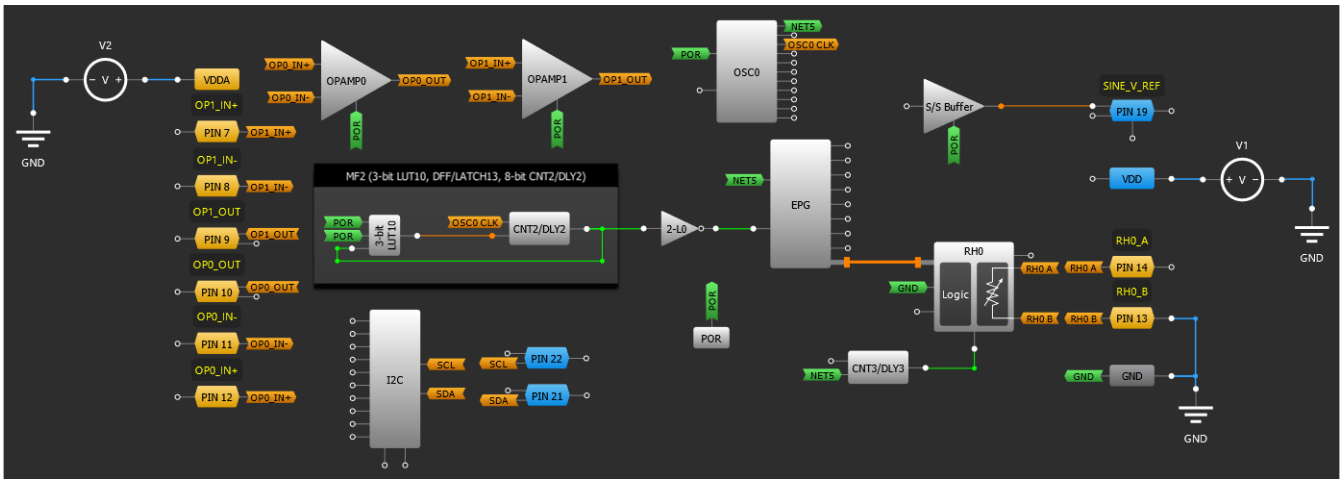

Figure 1. Sinewave Generator Design Block Diagram

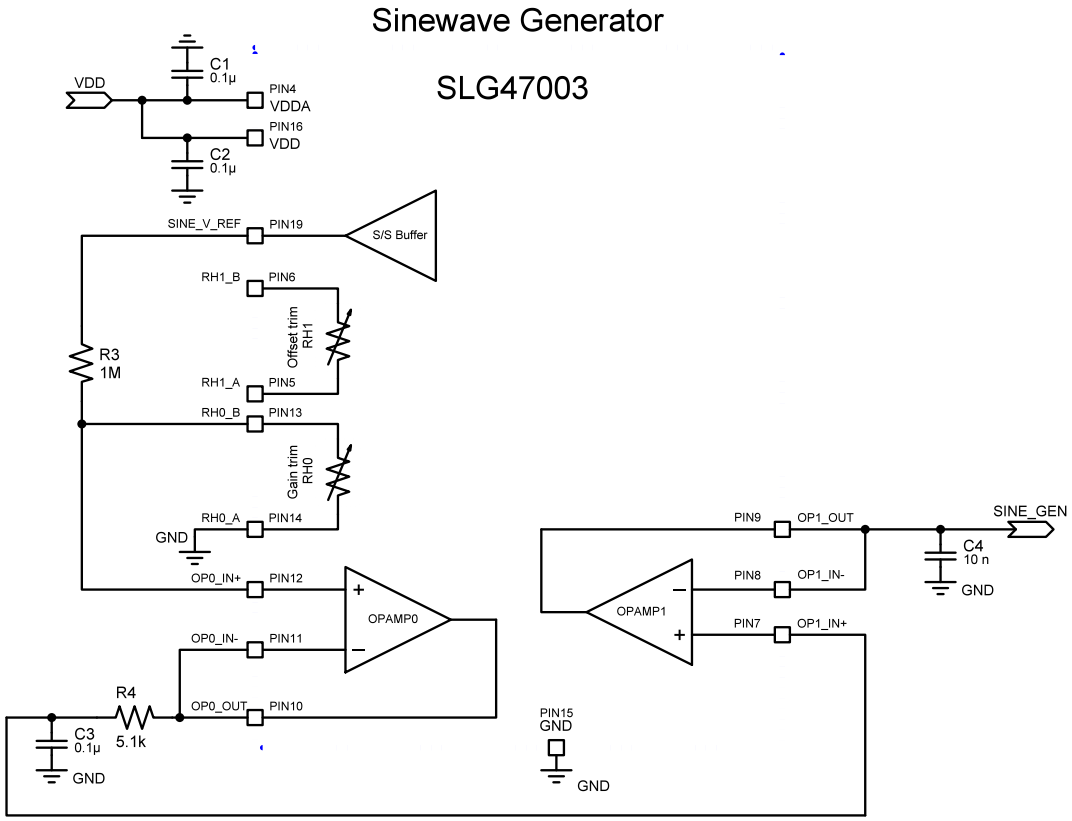

Figure 2. Sinewave Generator Typical Application Circuit

4. Design Operation

The operation of the signal generator is based on the ability to control the rheostat (RH0) by writing data to its counter from the EPG via an 8-bit parallel output (a new function implemented in AnalogPAK).

56 values that determine the shape of the output signal (sinusoidal) are recorded in the EPG memory (see Figure 3 and Figure 4).

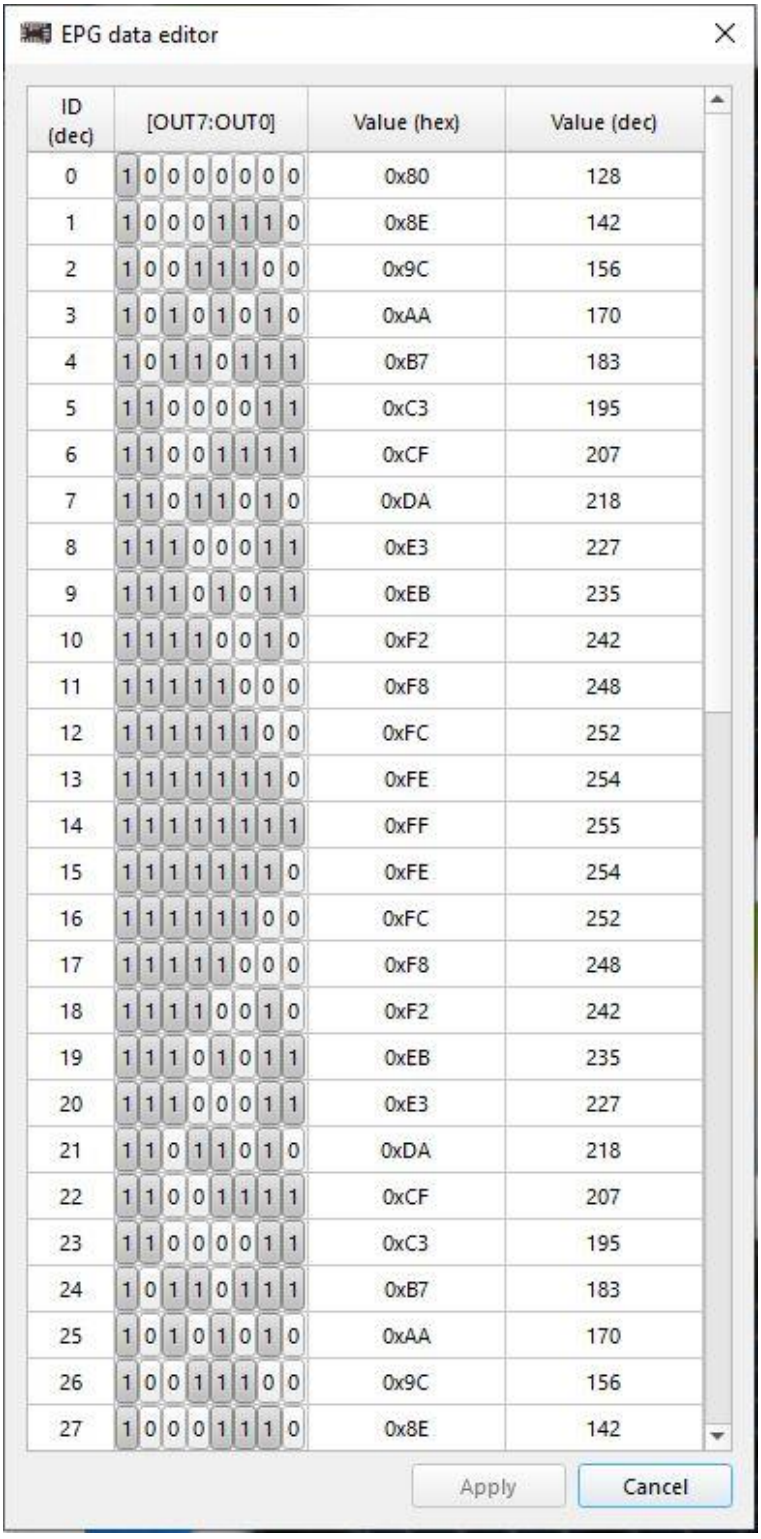

Figure 3. PGA Data Table for Values 0 to 27

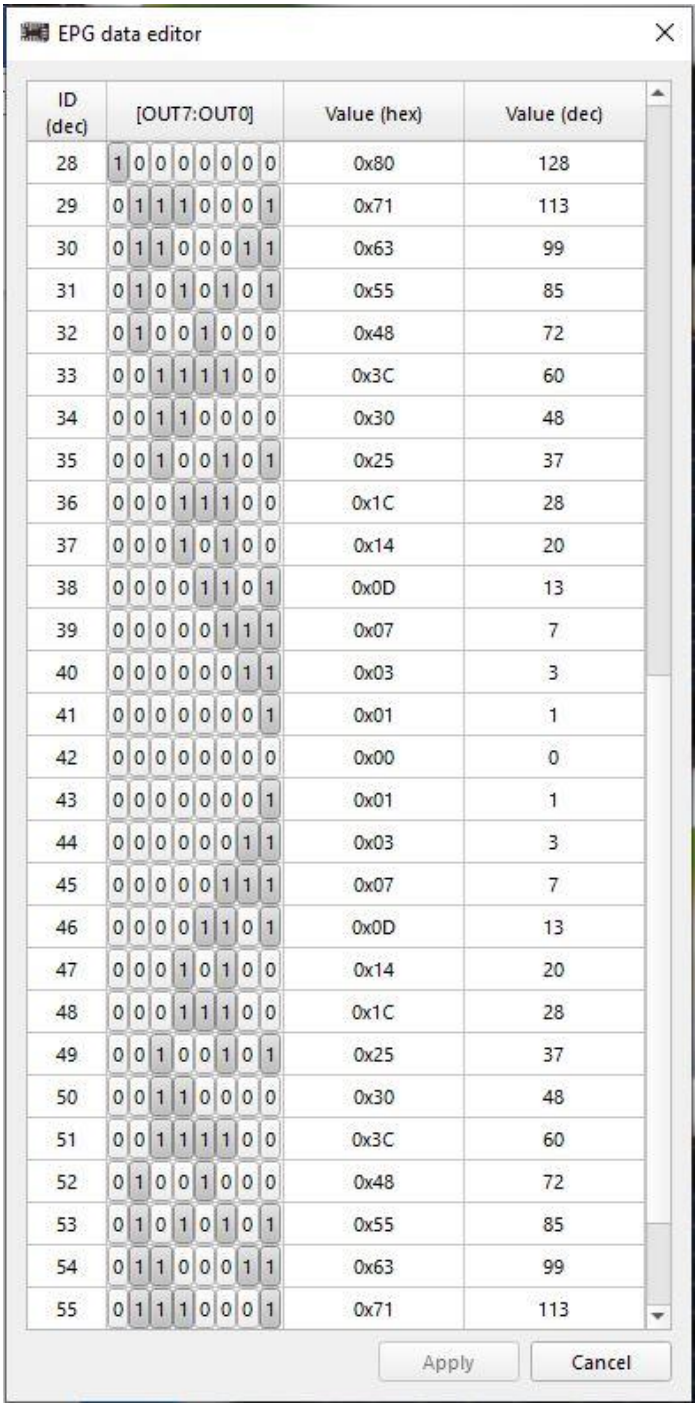

Figure 4. PGA Data Table for Values 28 to 55

Since the rheostat RH0 is included in the low side of the R3-RH0 voltage divider at the non-inverting input of the buffer on OpAmp0, the resistance of RH0 will determine the shape and offset of the output voltage of the buffer relative to the ground.

The maximum value of the amplitude of the output sinusoidal signal is determined by the value of the output voltage of the S/S Buffer macrocell and the resistance of R3 on the high side of the voltage divider R3-RH0 (see Figure 2).

Thanks to the new method of signal formation from the EPG using the patterns set in advance, the output sinusoidal signal does not contain significant noise, higher-order harmonics, etc. Additionally, for the final processing of the signal, a second-order filter R4C3, with a voltage follower on OpAmp1 is used (see Figure 2 and Figure 5).

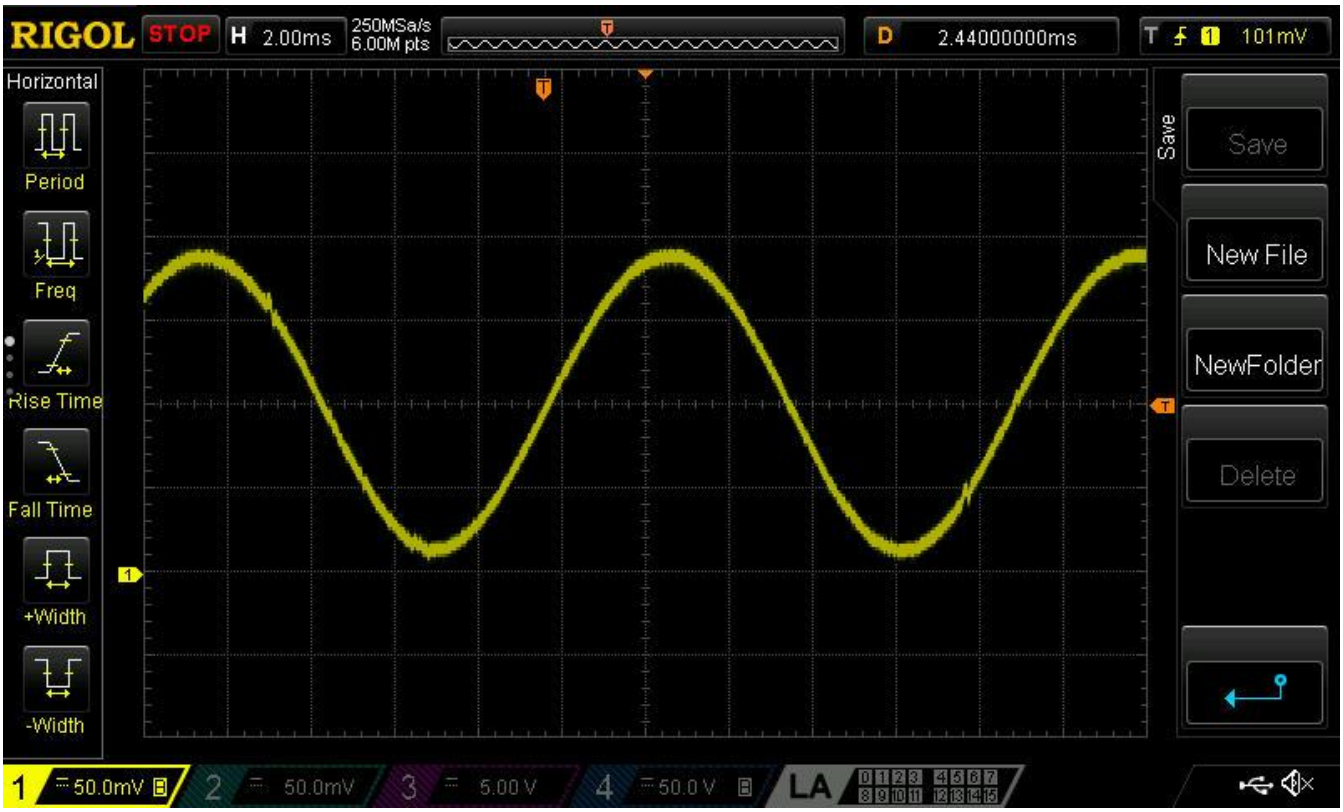

Figure 5. The Main Design Functionality

In addition, if the circuit is updated as shown in Figure 6, R3 can be used to adjust the amplitude and R5 can be used to adjust the offset of the output signal. I^2C commands can also set the maximum amplitude of the output signal (the output voltage of the S/S Buffer macrocell) and the output voltage frequency (the oscillator frequency and counter data of the DLY2 macrocell).

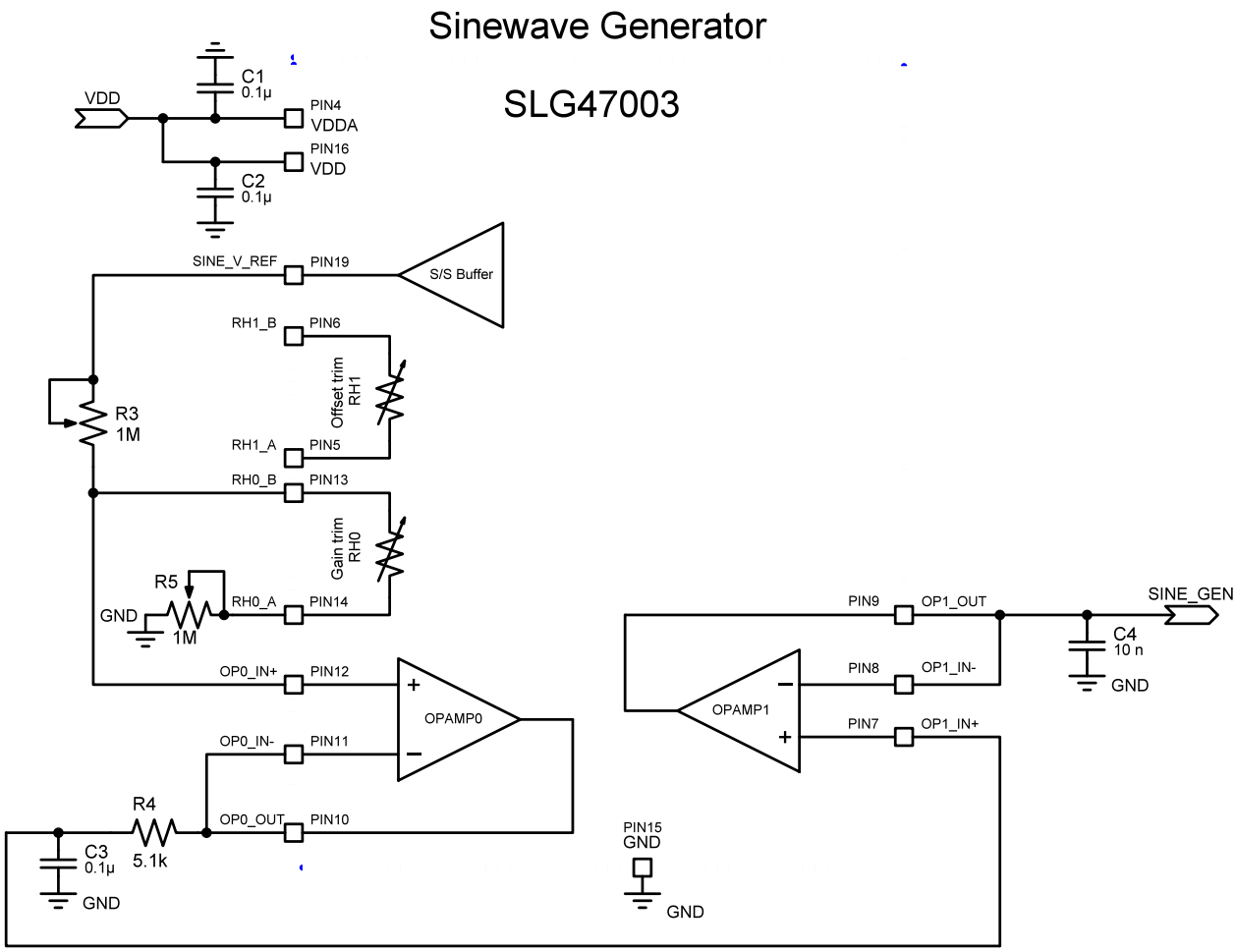

Figure 6. Updated Sinewave Generator typical Application Circuit

5. Conclusion

New functions introduced in AnalogPAK SLG47003 make it possible to create a universal signal generator (sinusoidal, rectangular, triangular, trapezoidal, etc.) with the help of a trivial amount of resources with the opportunity to adjust the frequency, amplitude, and offset using I^2C commands and other additional external elements.

6. Revision History

Revision	Date	Description
1.00	September 10, 2024	Initial release.

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